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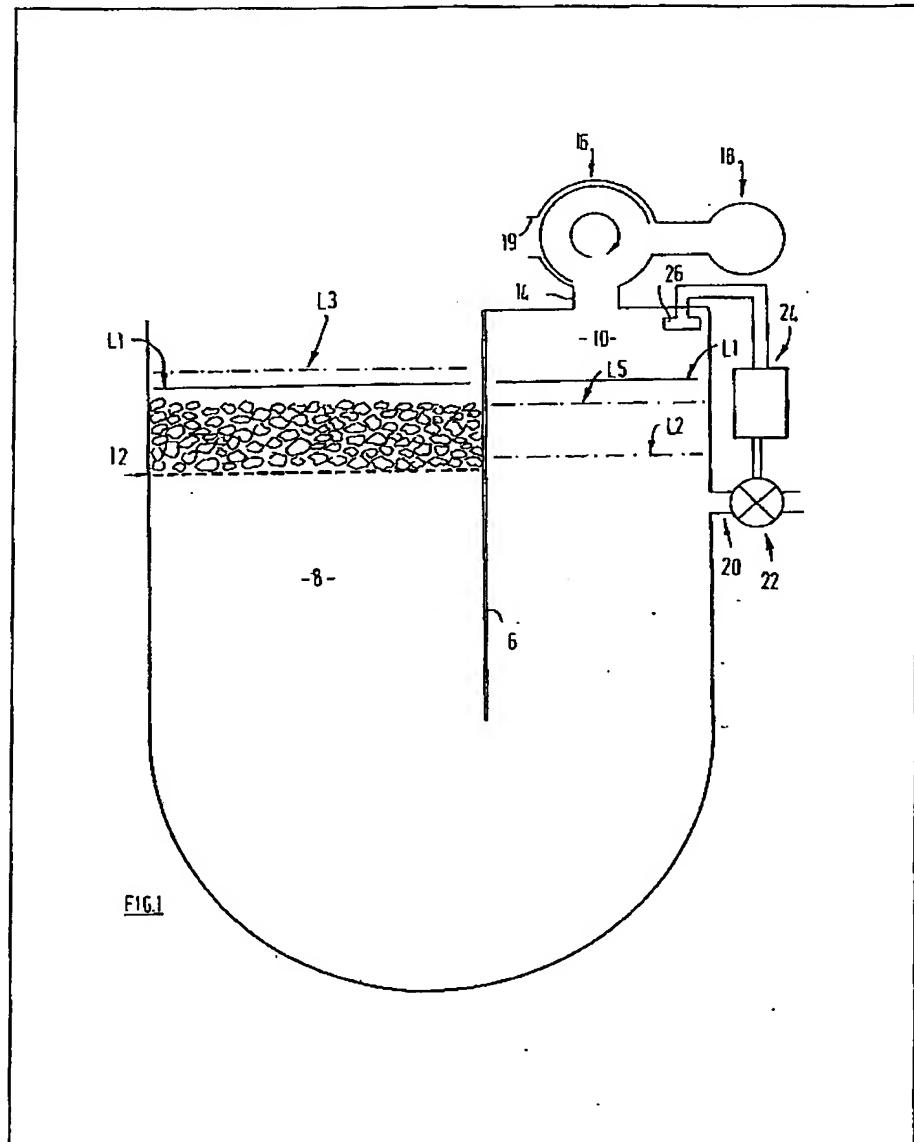
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**(54) Wash-box for separating materials of different densities**

(57) A wash-box for separating materials of different densities (e.g. coal and shale) comprises a stratification compartment (8), a perforate grid plate (12) extending across an upper part of the stratification compartment, and means (20, 22) by which water is admitted to the wash-box. The wash-box comprises a compression chamber (10) in underwater communication with the stratifi-

cation compartment, and pressure applying means (14,16,18,19) operative alternately to pressurise and de-pressurise the compression chamber (10), to cause repeated rising and falling of movement of water in the stratification compartment, to stratify raw material on the grid plate (12). The wash-box comprises a control device (24), comprising a pressure transducer (26) oper-

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## SPECIFICATION

## Improvements relating to materials separation

5 This Invention is concerned with improvements relating to the separation of materials, produced for example by a mining operation, into fractions of differing densities. 5

In for example the mining of coal, a mixture of coal and shale is produced from the face being mined, and it is necessary to separate the coal from the shale by the use of automatic machinery. Conventionally used for this operation is a wash-box essentially in the form of a vessel which affords one or more stratification compartments. A sloping, perforate grid plate extends across an upper part of each stratification compartment, and the vessel is filled to a level above the grid plate with a liquid such as water, the water flowing through the vessel from one end (the Inlet end) to an outlet end. Raw material is deposited on the grid plate at the inlet end, and means is provided to cause rising and falling movement of the water level in the stratification compartments. As water flows through the grid plate, the raw material is lifted from the grid plate. Since the heavier (i.e. more dense) particles will tend to fall through the water at a greater rate than the lighter (i.e. less dense) particles, as the material falls back onto the grid plate, the heavier particles (shale) will tend to form the bottom layer, and the lighter particles (coal) will tend to overlie the heavier layer. The water level in the stratification compartment is allowed to fall, and the operation is repeated, the raw material to be stratified into layers of different densities. 10

15 20 A convenient method of causing rising and falling movement of the water in the stratification compartment is to provide under water communication of the stratification compartment with a compression chamber, which is alternately pressurised and depressurised. Thus, a conventional wash-box is of generally U-shape in cross-section, and is divided longitudinally by a vertical wall which terminates short of the base of the wash-box, the region of the wash-box on one side of the wall being open to atmosphere, and affording the stratification compartment, and the region of the wash-box on the other side of the wall being enclosed, and affording the compression chamber. An inlet opening extends into the compression chamber whereby the chamber is alternately connected to a supply of air under pressure, and opened to atmosphere, conveniently by use of rotary valve. When the compression chamber is pressurised, the level of water therein is depressed, and the water flowing through the grid plate into the stratification 25 compartment, effecting stratification of the material above the grid plate as hereinbefore described. This stage may be referred to as the "pulsion" stroke. When the compression chamber is depressurised by being opened to atmosphere, water flows back through the grid plate. This stage may be referred to as the "suction" stroke. The operation is then repeated. 30

35 During the pulsion stroke, although the level in the stratification compartment is increased, much of the water entering the stratification compartment flows forwardly of the wash-box, tending to carry the coal forwardly, and leaves the wash-box through the outlet. Thus, during the suction stroke, a smaller quantity of water flows back through the bed of raw material and through the grid plate, and the raw material flows along the grid plate through the wash-box, by virtue of the slope of the grid plate and/or by virtue of the direction of flow of water through the wash-box. In certain circumstances, such as that known as "the 40 preliminary separation stage", the heavier fraction moves along the grid plate in one direction, by virtue of the slope of the grid plate, whilst the lighter fraction moves in the opposite direction, by virtue of the direction of flow of water through the wash-box. 40

45 Positioned above the grid plate and extending transversely to the direction of movement of the raw material is a separating device. Material passing above the separating device (predominantly coal) passes into a primary outlet of the wash-box, and material passing beneath the separating device (predominantly shale) falls from the grid plate into a reject extraction chamber of the wash-box. 45

A wash-box of the kind described in the last preceding paragraphs is described in detail in the specification of our U.K. Patent application number 1659/77 cog. 18172/77, or the equivalent U.S. Patent specification serial number 4176749. 50

50 Conventionally to ensure that the water in the compression chamber is returned to its optimum level prior to each pulsion stroke, water is admitted at a constant rate to the compression chamber. It is difficult and important to ensure that the rate of flow of water is correct, since if too much water is admitted, the strength of the pulsion stroke may be sufficient to disturb the stratification of the bed, and in particular to carry fine particles of shale upwardly through the bed, whilst if too little water is admitted, the strength of the pulsion 55 stroke may not be sufficient to raise the material from the grid plate for stratification to be effected. In general, once the level of water admission has been established, it is maintained unchanged. 55

In the operation of such wash-boxes, a problem is encountered when the material fed onto the grid plate at the inlet end includes a high proportion of fine coal. During the suction stroke, fine coal will be drawn into the spaces between the larger particles forming the upper layer of the bed, effectively preventing or reducing the 60 flow of water back from the stratification compartment into the compression chamber. Since there is no change in the rate of underwater admission, this effectively reduces the level of water in the compression chamber, and because of the increased volume of the space above the water level therein, the effect of the next admission of air under pressure to the compression chamber is reduced, reducing the quantity of water flowing upwardly through the grid plate, which significantly reduces the rate at which the material flows 65 through the wash-box. Such a reduction in through-flow can quickly cause a build-up of material on the grid 65

plate, to an extent where it becomes increasingly difficult for the upward flow of water through the grid plate to lift the material from the grid plate, and relatively quickly the bed may become immobile and the wash-box cease to operate. Additionally, in view of the negative pressure created beneath the grid plate, fine coal may be pulled through the grid plate to be discharged with the fine reject material.

5 It is one of the various objects of this invention to reduce the problem set out in the last preceding paragraph. 5

According to this invention there is provided a wash-box comprising at least one stratification compartment, a perforate grid plate extending across an upper part of the stratification compartment, means by which water is admitted to the wash-box, and means to cause rising and falling movement of water in the 10 stratification compartment and which comprises a compression chamber in underwater communication with the stratification compartment and pressure applying means operative alternately to pressurise and depressurise the compression chamber, wherein the wash-box comprises a control device adapted to generate a control signal which is functional of the pressure in the compression chamber, and which may be used to control the admission of water to the wash-box in accordance with said control signal. 10

15 The control signal may be displayed visually, to be utilised by an operative to manually adjust the admission of water to the wash-box in accordance with the control signal: such a facility is most advantageous in the initial setting up of the wash-box, to enable the wash-box to handle most conveniently a specific grade of raw material, and may be optionally utilised as a safety feature. Thus in the event, after setting up has been achieved, of the control signal varying by more than a predetermined amount from a 20 desirable value, an alarm may be activated to call to the attention of the operative the need for the admission of water to the wash-box to be adjusted. 20

Preferably however the wash-box comprises means responsive to the control signal automatically to control the admission of water to the wash-box in dependence upon said control signal.

Thus, in the event that the quantity of water returning to the compression chamber is reduced, the control 25 device will generate a control signal which will cause, or which will indicate the desirability of, an increase in the rate of flow of water to the wash-box, to ensure, or to tend to ensure, that the water level in the compression chamber returns to a level not significantly lower than a desired level. In this manner, the effectiveness of the application of air under pressure to the compression chamber will be retained or restored, retaining or restoring the amplitude of the pulsion stroke to an optimum desired level. In addition, 30 tendency for the creation of negative pressure beneath the grid plate, as would tend to draw fine coal deeply into the bed, is reduced. 30

The control device may be operative to measure the mean level of water in the compression chamber and to cause, or to indicate the desirability of, an increase the rate at which water is admitted to the wash-box, in the event of detecting a fall in said mean level. In this manner, the level of water in the compression chamber 35 after each suction stroke may be maintained at an optimum level, avoiding any significant reduction in amplitude of the pulsion stroke. 35

More conveniently however, the control device is operative to measure the pressure pertaining in the wash-box, and to cause, or to indicate the desirability of, an increase the rate at which water is admitted to the wash-box, in the event of detecting a reduction in said pressure, as would happen in the event of a 40 pulsion stroke being applied whilst some water is retained trapped above the grid plate. Whilst this has the disadvantage, that restoration action is not effected until a pulsion stroke of reduced amplitude has been applied to the stratification compartment, it does remove the problems of measuring the mean water level in the compression chamber, since in practice water will continue to flow through the grid plate, notwithstanding the presence of an excessive quantity of fine coal, although at a greatly reduced rate. 40

45 The pressure measured by the control device may be the maximum pressure pertaining in the wash-box on each pulsion stroke, or may be an average pressure over one complete cycle of pulsion and suction strokes. Preferably the control signal generated by the control device is proportional to the root-mean-square value of the pressure, conveniently that pertaining in the compression chamber, over one or more cycles of pulsion and suction strokes, and the control device controls the admission of water to the wash-box 50 in a manner such that the quantity of water additionally admitted is generally proportional to the difference between said root-mean-square value and a predetermined, desired value. 50

According to this invention there is also provided a method of separating coal from shale involving the use of a wash-box comprising a stratification compartment, a perforate grid plate extending across an upper part of the stratification compartment, means by which water is admitted to the wash-box, and means to cause 55 cyclic vertical movement of the water in the stratification compartment, wherein a measurement is taken during some at least of successive cycles of movement of the water in the stratification compartment, and such measurement is utilised to determine the rate at which water is admitted to the wash-box. 55

There will now be given a detailed description, to be read with reference to the accompanying drawings, of a wash-box which is a preferred embodiment of this invention, and of a method of separating coal from shale, which wash-box and which method have been selected to illustrate the invention by way of example. 60

In the accompanying drawings:-

Figure 1 is a schematic longitudinal sectional view of the preferred embodiment; and

Figure 2 is a schematic view of a control device of said wash-box.

The wash-box which is the preferred embodiment of this invention is basically similar to the wash-box 65 described in detail in the specification of our aforementioned U.K. and U.S. Patent specifications, to which

reference may be made for details of construction not included in the following description. The wash-box is thus in the form of an elongate vessel, generally U-shaped in cross-section, divided by lateral walls (not shown) into adjacent sections. The vessel is also divided by a longitudinally-extending vertical wall 6 (Figure 1) which terminates at a point spaced from the base of the vessel, to divide each section into a stratification compartment 8 and a compression chamber 10. Extending across an upper part of the stratification compartment is a perforate grid plate 12, and the vessel is initially filled to a level indicated L1, above the level of the grid plate, the compression chamber 10 being in underwater communication with the stratification compartment 8.

5 The stratification compartment 8 is open at the top to atmosphere, but the compression chamber 10 is 5 enclosed. However, extending into the compression chamber is an inlet 14, whereby the compression chamber may be placed alternately in communication with an airline 18, or an exhaust port 19, open to atmosphere, by means of a three-way valve 16.

10 In the operation of the wash-box which is the preferred embodiment of this invention, a quantity of raw material, which includes heavier and lighter fractions (e.g. shale and coal), is deposited on the grid plate 12.

15 The valve 16 is driven by a rotary drive-shaft (not shown) which at a first stage in a cycle of operation of the wash-box causes the compression chamber 10 to be placed in communication with the source 18 of air under pressure. Pressurisation of the chamber 10 depresses the water level from the level L1 to a level L2, forcing the water displaced into the stratification compartment, water flowing upwardly through the perforations in the grid plate 12, initiating a stratification of the material on the grid plate. Under normal 20 operating circumstances, the water in the stratification compartment may rise to a level shown L3, with excess water flowing in a direction forwardly of the wash-box, towards the outlet.

25 During a second stage of the cycle of operation of the wash-box, the rotary valve 16 places the inlet port 14 in communication with the outlet 19, opening the compression chamber 10 to atmosphere. Water from the stratification compartment now flows downwardly through the raw material on the grid plate and through

25 the perforations in the grid plate, returning to the compression chamber 10. To compensate for the water leaving the washbox, a supply of water enters the washbox through an underwater inlet 20, the rate of which is controlled by a valve 22. Under normal operating conditions, the quantity of water which flows through the inlet in each cycle of pulsion and suction strokes is sufficient to ensure that the level of water in both the stratification compartment and the compression chamber is restored to the original level L1.

30 Additionally however, since water is flowing through the inlet constantly, there will be some restoration of the level of water from the lower level L2 towards the original level L1 during the pulsion stroke, and prior to the suction stroke.

35 Thus, under normal operating conditions, with the water level in the compression chamber 10 restored to its original level L1, a similar displacement of water through the grid plate 12 is induced on the next

35 subsequent pulsion stroke.

In certain circumstances, particularly where the raw material contains an excessive quantity of fine material (particularly fine coal), during the second stage of the cycle of operation of the wash-box as above described, as the level of water in the stratification compartment 8 falls from the level L3, the fine material is drawn into the interstices between the larger particles of material on the grid plate, to an extent such as may 40 significantly reduce, or stop entirely, the downward flow of water from the stratification compartment. For example, the level of water in the stratification compartment may fall only to a level between the levels L3 and L1, and this quantity of water, together with the water admitted through the inlet 20, causes the level in the compression chamber 10 to rise only to the level L5 (between the levels L2 and L1). When air under pressure is next admitted to the compression chamber 10, by virtue of the larger volume of air in the 45 chamber above the water level, the effect of the pulse of air under pressure will be significantly reduced, significantly reducing a quantity of water flowing up through the grid plate. Thus, the raw material on the grid plate is lifted to a reduced extent, reducing the rate of movement of the material through the wash-box. This in turn reduces the rate at which material flows from the wash-box (either through the primary outlet for the coal or through one of the reject extraction chambers for the shale) which may in turn cause an 50 unacceptable build up of raw material on the grid plate. Additionally, because of the greater disparity between the level of water in the stratification compartment 8 and the compression chamber 10, a higher negative pressure is exerted beneath the grid plate 12, which increases the tendency for fine coal to be pulled through the bed of raw material and through the grid plate.

55 Further, where the quantity of raw material on the grid plate is measured by the use of a standpipe extending upwardly from the stratification compartment from a position beneath the grid plate, such a reduction in the effect of the pulse of air applied to the compression chamber 10 will be to reduce the level attained by the water in the standpipe. This may be detected by control mechanism controlling the operation of the wash-box, and may be taken erroneously as indicating a reduction of the level of raw material on the grid plate. This may result in a failure of the control mechanism to take appropriate action, to increase the 60 rate at which material flows along the grid plate from the wash-box, and this may similarly cause an unacceptable buildup of the quantity of raw material on the grid plate.

To minimise this possibility, the wash-box which is the preferred embodiment of this invention comprises a control device 24 adapted to take a measurement during some at least of successive cycles of movement of the water in the stratification compartment of conditions pertaining within the wash-box, such measurement 65 being utilised to determine the rate at which water is admitted to the wash-box. In particular, the control

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device 24 is adapted to generate a control signal which is functional of the water level attained in the compression chamber subsequent to depressurising of the chamber, and which is operative to control the valve 22.

The control device comprises an electrical pressure-to-voltage transducer 26, which may either be located 5 within the compression chamber 10, or mounted external to the compression chamber, but in communication therewith via a pipe fitting sealed through the roof of the chamber 10. 5

Over one complete cycle of pulsion and suction strokes (i.e. one complete rotation of the valve 16) the transducer 26 will generate a cyclically varying voltage wave-form whose peak to peak amplitude corresponds with the maximum and minimum air pressure in the chamber 10. The wave form is not 10 sinusoidal, and its shape will be dependant upon the characteristics of the valve 16, and in particular on the timing of the pressurising and depressurising of the chamber 10. The output of the transducer 26 is fed to a control unit 24, and in particular to an electronic processor P thereof, which extracts the root-mean-square (RMS) value of the wave form generated by the transducer 26, according to the transfer function: 10

$$15 \quad 15 \quad E_{p \text{ RMS}} = \sqrt{\frac{1}{T} \int_0^T E_p^2(t) dt}$$

20 where  $E_{p \text{ RMS}}$  is the root-mean-square value of  $E_p^2$ , the square of instantaneous pressure. The equation shows that the RMS value is independent of wave form and frequency. The output of the processor P is fed as an input to an integrator I, which derives a control signal. Conveniently the integrator has a time base which extends over a number of pulsation cycles of the washbox; in this manner, the effects on the control 25 signal of any short term variables (which may be an untypical variable occurring in a single cycle, or residual ripple) are reduced. 25

The control signal is displayed on a suitably calibrated meter M, to assist in adjusting the wash-box for optimum performance.

The control signal is applied to the input terminal 1 of a comparitor C, a comparative input, derived from an 30 adjustable set point variable voltage divider D, being applied to the input terminal 2. Any difference between the inputs to the comparitor C will result in an output voltage whose EMF is proportional to the difference between the control signal and the comparative signal, and whose polarity is indicative of whether the measured value is greater or less than the comparative value. The output voltage of the comparitor C is applied to a two term (proportional plus integral) process controller X, and thence to an actuator A, 35 mechanically coupled to the regulating valve 22.

In this manner, when a quantity of water is retained trapped above the grid plate, the control valve 22 will be operated to increase the rate of admission of water to the compression chamber 10, to restore the water level to its desired level, L1. 35

40 Thus, on the following pulsion stroke, the upward flow of water through the grid plate 12 will be restored, lifting the bed of raw material from the grid plate in a stratification operation, ensuring the desired movement of the raw material along the grid plate through the wash-box. 40

45 As long as the conditions which produced the wash-box condition remain, the rate of flow of water through the control valve will be retained at its higher level. However when those conditions have dissipated, the resumption of the full return flow into the compression chamber from the stratification compartment, together with the higher flow rate of input water, will cause the level to which the water returns in the compression chamber to exceed the level L1, which will cause the pressure transducer 26 to sense a greater pressure in the compression chamber over the next cycle of rising and falling movement of the water in the wash-box. This will cause the comparitor C to generate an output signal which will functional to reduce the rate of water flowing through the valve 22, returning such rate towards its original level. 45

50 Alternative to the extracting of a root-mean-square pressure value, the peak value of pressure detected in the chamber 10 by the transducer 26, during the pulsion stroke, may be utilised generally as follows:

The instantaneous output of the transducer 26 is converted from analogue to digital, and is fed to a processor which produces an output signal proportional to the peak value detected in the chamber 10 in each cycle. The output signals are fed to a comparator which compares the output signal with a desired 55 value, and if the output signal differs from said desired value by more than a predetermined amount, the comparator generates a control signal proportional to such difference, and of a sign (positive or negative) dependent upon whether the output signal is greater than or less than said desired value. The control signal is applied to a process controller, and to an actuator mechanically coupled to the regulating valve, as hereinbefore described. 55

60 By the use of this alternative method, the regulating valve 22 may be altered to compensate for variations in the conditions pertaining in the washbox more quickly than the method first described, in which the root-mean-square value is utilised. However, desirably such a control system would comprise means to prevent adjustment of the regulating valve for a single, perhaps untypical value, and until a trend has been established by comparing two or more successive control signals. 60

65 As a further alternative, it is envisaged that control over the regulating valve may be achieved jointly by 65

both the establishment of a root-mean-square value over a number of pulsation cycles, and by the measurement of the peak-to-peak amplitude of the pressure in the chamber 10.

As is conventional, the wash-box which is the preferred embodiment of this invention comprises a plurality of adjacent sections, each section comprising a stratification compartment 8 and communicating 5 compression chamber 10. Each compression chamber 10 comprises an individual inlet, through which air under pressure may be admitted, and each section comprises an under water inlet 20, having an adjustable valve 22 to control the flow of water into the section in accordance with the average pressure pertaining in the compression chamber over a complete cycle of pulsion and suction strokes of the wash-box.

Whilst in the wash-box which is the preferred embodiment of this invention, the control signal generated 10 by the control device is operative automatically to vary the rate at which water is admitted to the wash-box by direct control of the regulating valves 22, the invention may be utilised to advantage in a part-manual operation, particularly in which the control device displays the control signal in a manner such as to indicate to an operative the desirability of varying the rate at which water is admitted to the wash-box, which the operative may then carry out manually by manual adjustment of the valve 22. Such an operation is 15 particularly useful in enabling the wash-box to be "set up" for an operation to separate the constituents of a particular grade of raw materials, enabling the operative to be provided with information pertaining to the conditions in the wash-box, so that the operative may make compensatory adjustments to the rate at which water is admitted to the wash-box. By such use of the invention, it has been found possible to significantly reduce the period of time normally required for setting up such a wash-box. Preferably in such a system the 20 control device additionally comprises an alarm, which is activated in the event of the control signal subsequently varying by more than a predetermined amount, from a desirable value. In this manner after setting up of the wash-box, the attention of the operative may be called to the need for the admission of water to the wash-box to be adjusted, if the way in which the wash-box is operating begins to depart significantly from its optimum performance.

25 CLAIMS

1. A wash-box comprising a least one stratification compartment, a perforate grid plate extending across an upper part of the stratification compartment, means by which water is admitted to the washbox, and 30 means to cause rising and falling movement of water in the stratification compartment and which comprises a compression chamber in underwater communication with the stratification compartment and pressure applying means operative alternately to pressurise and de-pressurise the compression chamber, wherein the wash-box comprises a control device adapted to generate a control signal which is functional of the pressure in the compression chamber, and which may be used to control the admission of water to the 35 wash-box in accordance with said control signal.

2. A wash-box according to claim 1 comprising means responsive to the control signal automatically to control the admission of water to the wash-box in dependence upon said control signal.

3. A wash-box according to one of claims 1 and 2 wherein the control device is operative to measure the mean level of water in the compression chamber and is operative to generate a control signal to cause, or to 40 indicate the desirability of, an increase in the rate at which water is admitted to the wash-box, in the event of detecting a fall in said mean level.

4. A wash-box according to one of claims 1 and 2 wherein the control device is operative to measure the pressure pertaining in the wash-box, and is operative to generate a control signal to cause, or to indicate the desirability of, an increase the rate at which water is admitted to the wash-box, in the event of detecting a 45 reduction in said pressure.

5. A wash-box according to claim 4 wherein the pressure measured by the control device is a maximum pressure pertaining in the wash-box during a cycle of pulsion and suction strokes.

6. A wash-box according to claim 4 wherein the pressure measured by the control device is an average pressure over one or more complete cycle of pulsion and suction strokes.

50 7. A wash-box according to claim 6, as appendant to claim 2, wherein the control signal generated by the control device is proportional to the root-mean-square value of the pressure measured over one or more cycles of pulsion and suction strokes, and the control device is operative to control the admission of water to the wash-box in a manner such that the quantity of water additionally admitted is generally proportional to the difference between said root-mean-square value and a predetermined, desired value.

55 8. A wash-box according to any one of claims 1, 2, 4, 5, 6 and 7 wherein the control device comprises a pressure transducer in communication with the compression chamber.

9. A wash-box according to claim 8 wherein the control device comprises a comparitor to which a control signal from the pressure transducer is applied, the comparitor being operative to compare said control signal with a predetermined value and to provide an output signal proportional to the difference between the 60 control signal and said predetermined value.

10. A wash-box according to claim 9 wherein said means by which water is admitted to the wash-box comprises a control valve, and the control device comprises an actuator operative to adjust the control valve in accordance with the output applied thereto from the comparitor.

11. A wash-box according to any one of the preceding claims wherein the control device comprises an 65 alarm which is activated when the control signal generated varies by more than a predetermined amount

from a desirable value.

12. A method of separating coal from shale involving the use of a wash-box comprising a stratification compartment, a perforate grid plate extending across an upper part of the stratification compartment, means by which water is admitted to the wash-box, and means to cause cyclic vertical movement of water in the 5 stratification compartment, wherein a measurement is taken during some at least of successive cycles of movement of the water in the stratification compartment, and such measurement is utilised to determine the rate at which water is admitted to the wash-box. 5

13. A method according to claim 12 wherein the cyclic vertical movement is repeated rising and falling movement of the water in the stratification compartment.

10 14. A method according to one of claims 12 and 13 wherein said measurement is of a value which is functional of the extent of falling movement of the water in the stratification compartment. 10

15. A method according to claim 14 wherein said measurement is of a mean water level in the wash-box beneath the grid plate.

16. A method according to any one of the preceding claims wherein said means to cause such cyclic 15 vertical movement of the water in the stratification compartment comprises a compression chamber in underwater communication with the stratification compartment and pressure applying means operative alternately to pressurise and de-pressurise the compression chamber. 15

17. A method according to claim 16, as appendant to claim 15, wherein said measurement is of a water level in the compression chamber.

20 18. A method according to claim 17 wherein said measurement is of the mean water level in the compression chamber. 20

19. A method according to claim 16, as appendant to claim 14, wherein the measurement is of the pressure in the compression chamber.

20. A method according to claim 19 wherein said measurement is of the maximum pressure in the 25 compression chamber. 25

21. A method according to claim 19 wherein said measurement is of the mean pressure in the compression chamber over one or more complete cycles of vertical movement of water in the stratification compartment.

22. A method according to any one of claims 12 to 21 wherein said means by which water is admitted to 30 the wash-box comprises a control valve, and the method involves the use of a control device which is operative automatically to take said measurement, and to adjust the control valve to vary the rate at which water is admitted to the wash-box automatically in accordance with said measurement. 30

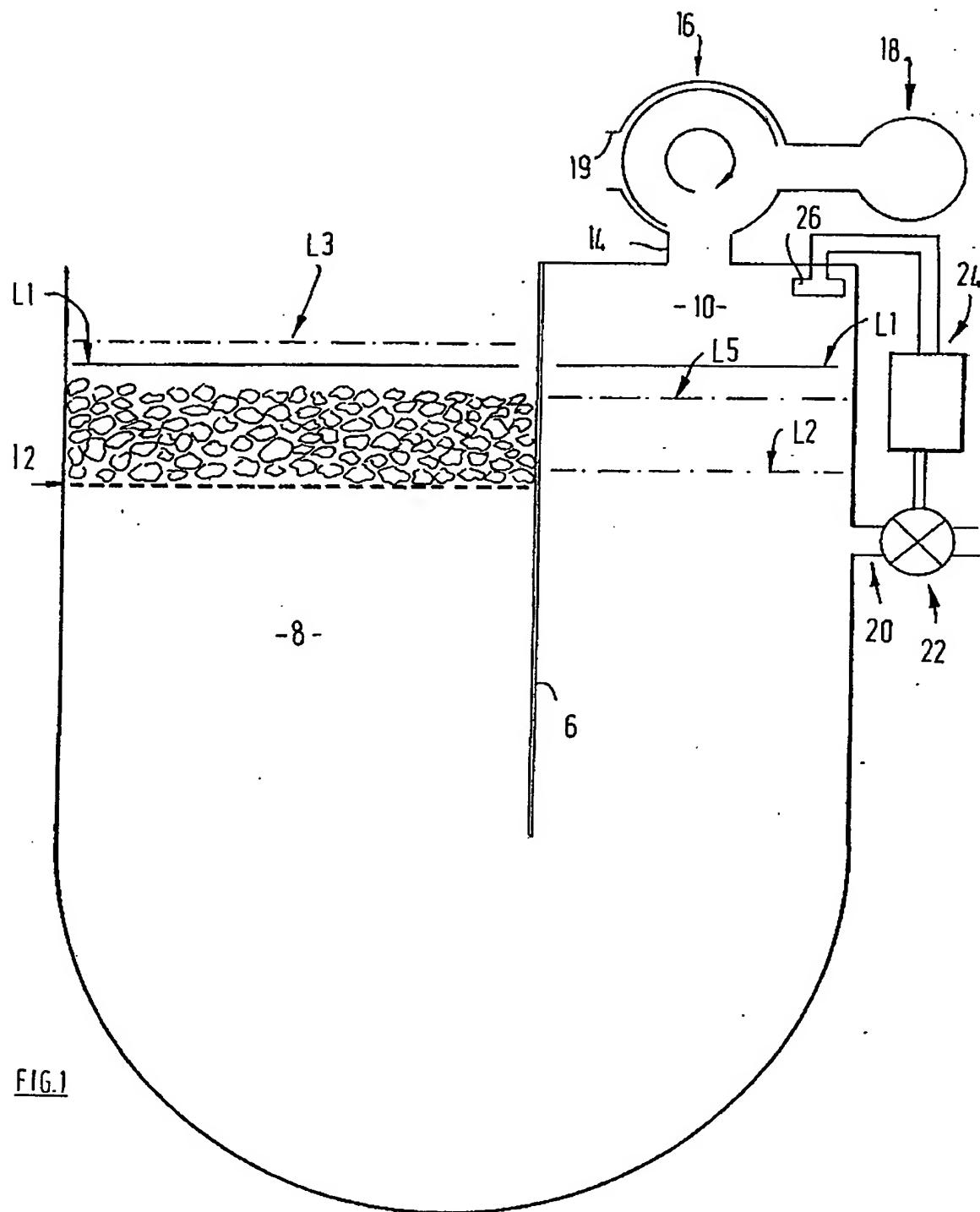
23. A method according to any one of claims 12 to 22 wherein said measurement is taken on every cycle of vertical movement of water in the stratification compartment.

35 24. A wash-box constructed, arranged and adapted to operate substantially as hereinbefore described with reference to the accompanying drawings. 35

25. A method of separating coal from shale, when carried out substantially as hereinbefore described and shown in the accompanying drawings.

26. Any novel feature or novel combination of features hereinbefore described and/or shown in the 40 accompanying drawings. 40

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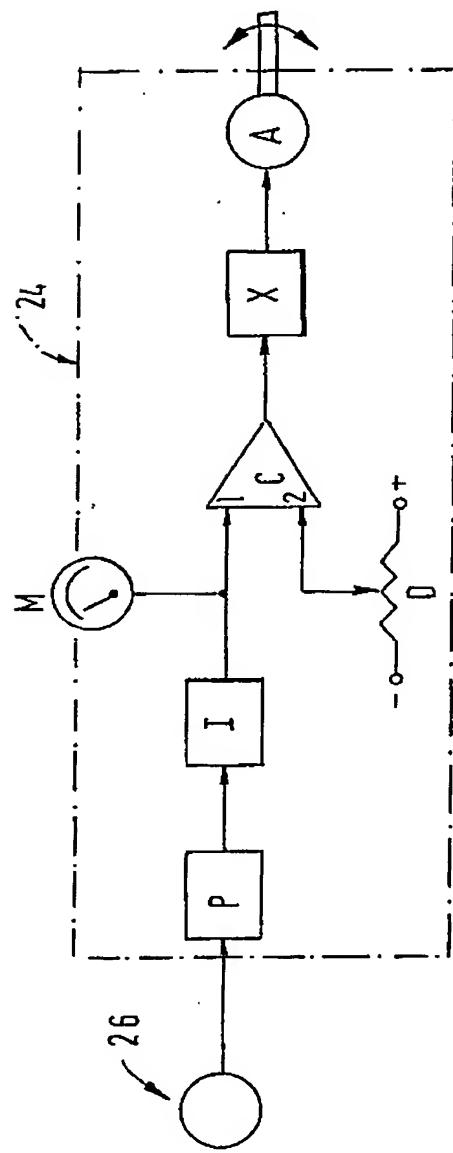


FIG.2